

Quiz Wed Sept 26 : Section 23.2
Wed Sept 27 : Section 23.6

Test 1

Thurs Sept 28

Covers Ch 23

Bring calculator

Bring music earplugs


Practice Problems on website.

Product Rule $(uv)' = uv' + v u'$

Quotient Rule $\left(\frac{u}{v}\right)' = \frac{v u' - u v'}{v^2}$

23.7 The General Power Rule
and The Chain Rule Cont'd

The Chain Rule: Calculation Version

$$\frac{d}{dx} [f(g(x))] = f'(g(x)) \cdot g'(x)$$


derivative of outside function, keeping inside function the same

derivative of inside function

Ex: $y = (x^7 + 3x)^3$
 $y' = 3(x^7 + 3x)^2(7x^6 + 3)$

The Chain Rule: Formal Version

$$\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$$

$u =$ inside function
 $\frac{du}{dx} =$ derivative of inside function

Ex: $y = (x^7 + 3x)^3$
 $y = u^3 \quad u = x^7 + 3x$

$$\begin{aligned} \frac{dy}{dx} &= \frac{dy}{du} \frac{du}{dx} \\ &= 3u^2(7x^6 + 3) \\ &= 3(x^7 + 3x)^2(7x^6 + 3) \end{aligned}$$

Ex: Find $\frac{dy}{dx}$

$$a) y = 2(1-5x^4)^7$$

$$\begin{aligned}\frac{dy}{dx} &= 14(1-5x^4)^6(-20x^3) \\ &= -280x^3(1-5x^4)^6\end{aligned}$$

$$b) y = 10x^3 - 6(1+5x)^4$$

$$\begin{aligned}\frac{dy}{dx} &= 30x^2 - 24(1+5x)^3(5) \\ &= 30x^2 - 120(1+5x)^3\end{aligned}$$

$$c) y = \sqrt{2+4x^3}$$

$$y = (2+4x^3)^{\frac{1}{2}}$$

$$\begin{aligned}\frac{dy}{dx} &= \frac{1}{2}(2+4x^3)^{-\frac{1}{2}}(12x^2) \\ &= \frac{6x^2}{\sqrt{2+4x^3}}\end{aligned}$$

$$d) y = \frac{1}{(1+17x^2)^4}$$

$$y = (1+17x^2)^{-4}$$

$$\frac{dy}{dx} = -4(1+17x^2)^{-5} (34x)$$

$$= \frac{-136x}{(1+17x^2)^5}$$

Ex: Simplify y' where

$$y = \underbrace{4x^2}_{u} \underbrace{(8x+7)^6}_{v}$$

$$(uv)' = uv' + vu'$$

$$\begin{aligned} y' &= 4x^2 [(8x+7)^6]' + (8x+7)^6 (8x)' \\ &= 4x^2 [6(8x+7)^5 (8)] + (8x+7)^6 (8x)' \end{aligned}$$

$$= 8x(8x+7)^5 [24x + (8x+7)]$$

$$= 8x(8x+7)^5 (32x+7)$$

Ex: Find $f'(1)$ for

$$f(x) = [(3x+2)(9x^2+1)]^4$$

Chain Rule
and Product Rule